



## PHYH gene

phytanoyl-CoA 2-hydroxylase

### Normal Function

The *PHYH* gene provides instructions for making an enzyme called phytanoyl-CoA hydroxylase. This enzyme is critical for the normal function of cell structures called peroxisomes. These sac-like compartments contain enzymes needed to break down many different substances, including fatty acids and certain toxic compounds.

One substance that is broken down in peroxisomes is phytanic acid, a type of fatty acid obtained from the diet (particularly from beef and dairy products). Phytanoyl-CoA hydroxylase is responsible for one of the first steps in breaking down phytanic acid as part of a process known as alpha-oxidation. In subsequent steps, additional enzymes in peroxisomes and other parts of the cell further process this compound into smaller molecules that the body can use for energy.

Researchers suspect that phytanoyl-CoA hydroxylase may have other functions in addition to its role in breaking down phytanic acid. For example, this enzyme appears to help determine the number of peroxisomes within cells and is involved in regulating their activity.

### Health Conditions Related to Genetic Changes

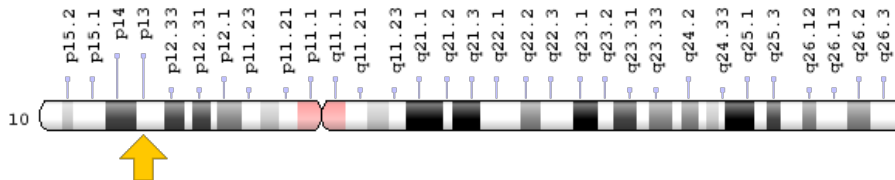
#### Refsum disease

Mutations in the *PHYH* gene have been found to cause more than 90 percent of all cases of Refsum disease. About 30 mutations in this gene have been identified. These mutations alter the structure or production of phytanoyl-CoA hydroxylase, which reduces the enzyme's activity. A shortage of this enzyme disrupts the breakdown of phytanic acid in peroxisomes. As a result, phytanic acid and related compounds build up in the body's tissues. The accumulation of phytanic acid is toxic to cells, although it is unclear how an excess of this substance affects vision and smell and causes the other specific features of Refsum disease.

## Chromosomal Location

Cytogenetic Location: 10p13, which is the short (p) arm of chromosome 10 at position 13

Molecular Location: base pairs 13,277,796 to 13,300,130 on chromosome 10 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

## Other Names for This Gene

- LN1
- LNAP1
- PAHX
- PAHX\_HUMAN
- PHYH1
- phytanic acid oxidase
- phytanoyl-CoA alpha hydroxylase
- phytanoyl-CoA 2 oxoglutarate dioxygenase
- phytanoyl-CoA alpha-hydroxylase
- phytanoyl-CoA dioxygenase, peroxisomal

## Additional Information & Resources

### Educational Resources

- Basic Neurochemistry (sixth edition, 1999): Peroxisomal Disease  
<https://www.ncbi.nlm.nih.gov/books/NBK28022/>
- Madame Curie Bioscience Database: The Biogenesis and Cell Biology of Peroxisomes in Human Health and Disease  
<https://www.ncbi.nlm.nih.gov/books/NBK6339/>

## GeneReviews

- Refsum Disease  
<https://www.ncbi.nlm.nih.gov/books/NBK1353>

## Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28PHYH%5BTIAB%5D%29+OR+%28phytanoyl-CoA+2-hydroxylase%5BTIAB%5D%29%29+OR+%28PAHX%5BTIAB%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D>

## OMIM

- PHYTANOYL-CoA HYDROXYLASE  
<http://omim.org/entry/602026>

## Research Resources

- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=PHYH%5Bgene%5D>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=8940](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=8940)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/5264>
- UniProt  
<http://www.uniprot.org/uniprot/O14832>

## **Sources for This Summary**

- GeneReview: Refsum Disease  
<https://www.ncbi.nlm.nih.gov/books/NBK1353>
- Jansen GA, Hogenhout EM, Ferdinandusse S, Waterham HR, Ofman R, Jakobs C, Skjeldal OH, Wanders RJ. Human phytanoyl-CoA hydroxylase: resolution of the gene structure and the molecular basis of Refsum's disease. *Hum Mol Genet.* 2000 May 1;9(8):1195-200.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/10767344>
- Jansen GA, Ofman R, Ferdinandusse S, Ijlst L, Muijsers AO, Skjeldal OH, Stokke O, Jakobs C, Besley GT, Wraith JE, Wanders RJ. Refsum disease is caused by mutations in the phytanoyl-CoA hydroxylase gene. *Nat Genet.* 1997 Oct;17(2):190-3.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/9326940>
- Jansen GA, Wanders RJ, Watkins PA, Mihalik SJ. Phytanoyl-coenzyme A hydroxylase deficiency -- the enzyme defect in Refsum's disease. *N Engl J Med.* 1997 Jul 10;337(2):133-4.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/9221344>

- Jansen GA, Waterham HR, Wanders RJ. Molecular basis of Refsum disease: sequence variations in phytanoyl-CoA hydroxylase (PHYH) and the PTS2 receptor (PEX7). *Hum Mutat.* 2004 Mar;23(3):209-18. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/14974078>
- McDonough MA, Kavanagh KL, Butler D, Searls T, Oppermann U, Schofield CJ. Structure of human phytanoyl-CoA 2-hydroxylase identifies molecular mechanisms of Refsum disease. *J Biol Chem.* 2005 Dec 9;280(49):41101-10. Epub 2005 Sep 25.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16186124>
- Mihalik SJ, Morrell JC, Kim D, Sacksteder KA, Watkins PA, Gould SJ. Identification of PAHX, a Refsum disease gene. *Nat Genet.* 1997 Oct;17(2):185-9.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/9326939>
- Mukherji M, Chien W, Kershaw NJ, Clifton IJ, Schofield CJ, Wierzbicki AS, Lloyd MD. Structure-function analysis of phytanoyl-CoA 2-hydroxylase mutations causing Refsum's disease. *Hum Mol Genet.* 2001 Sep 1;10(18):1971-82.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/11555634>
- Wanders RJ, Komen JC. Peroxisomes, Refsum's disease and the alpha- and omega-oxidation of phytanic acid. *Biochem Soc Trans.* 2007 Nov;35(Pt 5):865-9. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/17956234>
- van den Brink DM, Wanders RJ. Phytanic acid: production from phytol, its breakdown and role in human disease. *Cell Mol Life Sci.* 2006 Aug;63(15):1752-65. Review.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16799769>

---

Reprinted from Genetics Home Reference:  
<https://ghr.nlm.nih.gov/gene/PHYH>

Reviewed: January 2010  
Published: March 21, 2017

Lister Hill National Center for Biomedical Communications  
U.S. National Library of Medicine  
National Institutes of Health  
Department of Health & Human Services